

example, general file names instead of URLs may be used in a distributed file sharing system with compressed Bloom filters.

## 5 WHAT IS CLAIMED IS:

1 1. A distributed, compressed bloom filter Web server providing reduced probabilities of false  
2 positives, comprising:

3 a plurality of cache servers each having a cache memory and a cache processor coupled to  
4 the memory that is operative (1) to represent Web objects stored in its cache memory as a  
5 compressed Bloom filter data array having a preselected number of hash functions and a preselected  
6 array size which have been chosen to minimize the rate of false positives for a preselected  
7 transmission compression size, (2) to compress the Bloom filter data array to said transmission  
8 compression size, and (3) to periodically disseminate the compressed Bloom filter data array to  
9 neighboring servers when there is a change in its stored Web objects.

1 2. The distributed, compressed Bloom filter Web server providing reduced probabilities of false  
2 positives of claim 1, wherein the Bloom filter data array size is made as large as possible for a given  
3 cache memory size and the number of hash functions is chosen to minimize the rate of false positives  
4 for a preselected transmission compression size.

1 3. The distributed, compressed Bloom filter Web server providing reduced probabilities of false  
2 positives of claim 1, wherein arithmetic coding is employed to compress the Bloom filter data array  
3 to said transmission compression size.

1 4. The distributed, compressed Bloom filter Web server providing reduced probabilities of false  
2 positives of claim 1, wherein said cache processor is further operative to store in its cache memory  
3 at least one other decompressed Bloom filter data array each representative of the Web objects of  
4 another, at least one neighboring Web server.

1 5. A method reducing false positives in a network having distributed Web servers each storing  
2 information in cache memory as a Bloom filter data array representative of the information in its  
3 cache memory and broadcasting that data array to other Web servers periodically, comprising:

4 1) fixing a compression size for transmission of the Bloom filter data array at each Web  
5 server;

6 (2) choosing the number of hash functions and the array size so that the Bloom filter data  
7 array minimizes the rate of false positives when it is compressed down to the fixed compression size;  
8 and

9 (3) broadcasting the compressed Bloom filter data array of the fixed compression size to  
10 neighboring Web servers whenever there is a change in the contents of its cache memory.

1 6. A distributed computer network, comprising:

2 a plurality of periodically intercommunicating distributed network nodes;

3 each node including a cache memory and a processor coupled to the cache memory operative

4 to (1) represent its memory contents as a compressed Bloom filter data structure having a preselected

5 number of hash functions and a preselected array size which have been chosen for a target  
6 compression size to optimize at least one of the rate of false positives of the Bloom filter  
7 representing the memory contents and the computational requirements of the preselected number of  
8 hash functions, to (2) compress the Bloom filter data structure to the target compression size using  
9 a predetermined compression algorithm, and to (3) broadcast the compressed Bloom filter data  
10 structure to at least one other node whenever the contents of its cache memory has changed.

1 7. The distributed computer network of claim 1, wherein said nodes are Web proxy servers.

1 8. The distributed computer network of claim 1, wherein said nodes are mobile or stationary agents  
2 in a network of mobile nodes, and the Web objects correspond to agent locations.

1 9. The distributed computer network of claim 1, wherein said predetermined compression algorithm  
2 is arithmetic coding.

1 10. A method employing compressed Bloom filters for storing and transmitting data in a distributed  
2 network of nodes each having a processor coupled to a memory, comprising:

3       representing the data contents of a memory of a node as a compressed Bloom filter data  
4       structure stored in memory of a node having a preselected number of hash functions and a  
5       preselected array size which have been chosen to optimize at least one of the rate of false positives  
6       of the Bloom filter representing the data contents and the computational requirements of the  
7       preselected number of hash functions for a transmission compression size;  
8       compressing the Bloom filter data structure to the transmission compression size; and  
9       periodically transmitting the compressed Bloom filter data structure to at least one other  
10      node.

11. A method of storing data in memory for transmission, comprising:

2       representing the data as a compressed Bloom filter data structure in said memory having a  
3       preselected number of hash functions and a preselected array size which have been chosen for a  
4       target transmission compression size to optimize at least one of the rate of false positives of the  
5       Bloom filter representing the data and the computational requirements of the preselected number of  
6       hash functions.

12. A distributed computer network, comprising:

2       a plurality of periodically intercommunicating distributed network nodes;

3       each node including a cache memory and a processor coupled to the cache memory operative  
4       to (1) represent its memory contents as a compressed Bloom filter data structure having a preselected

5 number of hash functions and a preselected array size which have been chosen for a target rate of  
6 false positives to optimize at least one of the compression size of the Bloom filter representing the  
7 memory contents and the computational requirements of the preselected number of hash functions,  
8 to (2) compress the Bloom filter data structure to the target compression size using a predetermined  
9 compression algorithm, and to (3) broadcast the compressed Bloom filter data structure to at least  
10 one other node whenever the contents of its cache memory has changed.

1 13. The distributed computer network of claim 12, wherein said nodes are Web proxy servers.

1 14. The distributed computer network of claim 12, wherein said nodes are mobile or stationary  
2 agents in a network of mobile nodes, and the Web objects correspond to agent locations.

1 15. The distributed computer network of claim 12, wherein said predetermined compression  
2 algorithm is arithmetic coding.

1 16. A method employing compressed Bloom filters for storing and transmitting data in a distributed  
2 network of nodes each having a processor coupled to a memory, comprising:

3       representing the data contents of a memory of a node as a compressed Bloom filter data  
4       structure stored in memory of a node having a preselected number of hash functions and a  
5       preselected array size which have been chosen to optimize at least one of the transmission  
6       compression size of the Bloom filter representing the data contents and the computational  
7       requirements of the preselected number of hash functions for a given rate of false positives;  
8       compressing the Bloom filter data structure to the transmission compression size; and  
9       periodically transmitting the compressed Bloom filter data structure to at least one other  
10      node.

17. A method of storing data in memory for transmission, comprising:

2       representing the data as a compressed Bloom filter data structure in said memory having a  
3       preselected number of hash functions and a preselected array size which have been chosen for a  
4       target rate of false positives to optimize at least one of the transmission compression size of the  
5       Bloom filter representing the data and the computational requirements of the preselected number of  
6       hash functions.